# MARINE BIOLOGY IN WESTERN AUSTRALIA.

*Being the Anniversary Address of the President, Session* 1913-1914.

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By

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Fortunately a considerable amount of latitude is always allowed in the choice of a subject for a Presidential Address. I feel that I shall be availing myself of that latitude in my address to you this evening.

I need scarcely enumerate the events of the year; they will be in the memory of you all. A petition addressed to His Majesty, King George V. was forwarded on June 27th, 1913, asking for Royal Assent to the change of designation of the Natural History and Science Society to that of "The Royal Society of Western Australia." The petition was granted, and on December 9th, 1913, the members of the old Society were informed of the change. During the summer recess a new set of rules was drawn up, and at the first meeting in 1914 it was formally agreed that the Natural History and Science Society of W.A. should be known in future as the Royal Society of Western Australia. It will not perhaps be felt out of place if I take a glance backward at the work of the old Society, and a look ahead at the prospects before us.

The old Society was founded in 1897 as the Mueller Botanical Society, its aim being "the study of Botany and relative scientific subjects, to be promoted by periodical meetings, conversaziones and field excursions, and the formation of a library."

Previous to this date, however, the Flora of Western Australia had been studied by both visiting botanists and by the settlers. I cannot pass without mentioning the name of James Drummond, who might be styled the first colonial botanist of West Australia. Drummond died in the year 1863. The Society must have done much in its early days to stimulate and foster the study of the West Australian flora, but others better informed than myself in the history of W.A. will perhaps tell the story of those interesting times. Some of the very early papers published by the Society were rather of an elementary nature, not containing, I am afraid, much original research. It was, however, perhaps not exactly the first duty of a society in those days to publish highly technical papers, and most of the keen members—if not all—had daily work to perform which was not related to the study of plant life.

I often wish we had more of the keen old amateur naturalists of the last generation with us now. There are too few at the present day who devote themselves to the study of nature in their hours of relaxation.

About the year 1900, we find the Mueller Botanical Society with a number of ardent workers, amongst whom might be mentioned Messrs. Purdie, C. R. P. Andrews, Hursthouse, Drs. Tratman and Morrison, and the two German workers, Drs. Diels and Prietzel.

Many new records resulted from their work in the years that followed. The scope of the Society was, however, becoming wider and so, in 1904, the title was changed to that of "The West Australian Natural History Society." Under this name the Journal was published until quite recently and papers coming within the scope of Botany, Zoology, and Geology were presented. Finally, a further change was made and the title expanded to read "The Natural History and Science Society of Western Australia." The last volume of the Journal to be published under this name will be No. V., containing papers and details of meetings ending with that of March 10th, 1914.

## MARINE BIOLOGY IN WESTERN AUSTRALIA.

Let me now proceed to the subject which I have taken for my address. What is Marine Biology? Perhaps at the same time I should try and answer the further question (which is still so often asked in the British Empire when you mention science), What is the *Use* of Marine Biology?

The answer to the first question is short—Marine Biology is the study of the organisms of the sea, both animal and vegetable; their relation to each other, and to the ever-changing conditions of their environment. To the second question I require to say more. In the first place I plead the study of marine biology simply from the point of view of pure knowledge; from a desire to know and understand the earth and all that exists thereon. It is not generally known, I am afraid, that very many more groups of animals from the lowest to the highest are represented in the sea than on land and in the air. Very many problems of the greatest scientific importance are to be solved by the study of the sea and all that therein is. In fact it has been ably suggested that life originated in the sea, and that the saline constituents of mammalian blood indicate even now the composition of the medium once bathing the bodies of aquatic ancestors. The famous poet Goethe makes use of his knowledge as a scientist when he puts into the mouth of Thales in "Faust," Part II., the words—

> "Alles ist aus dem Wasser entsprungen!
> Alles wird durch das Wasser erhalten!
> Ozean, gönn' uns dein ewiges Walten!

The following table indicates roughly the distribution of the chief animal groups respecting their habitat:—

| LAND ANIMALS. | MARINE ANIMALS. |
|---|---|
| Protozoa | Protozoa |
| Sponges, (few species in fresh water) | Sponges |
| Coelenterata (rare in fresh water) | Coelenterata |
| —— | Echinodermata (all groups) |
| Platyhelminthes (fresh water and parasitic) | Platyhelminthes |
| Nemerteans—(exceptional on land) | Nemerteans |
| Rotifera—(fresh water) | Rotifera |
| Gastropoda (land and fresh water) | Gastropoda |
| (Lamellibranchcata, few fresh water) | Lamellibrancheata |
| —— | Cephalopoda |
| —— | Solenogastres |
| —— | Scaphopoda |
| Nematoda | Nematoda |
| Oligochaeta (land and fresh water) | Oligochaeta (few species) |
| Polychaeta (very few fresh water) | Polychaeta |
| Hirudinea (fresh water) | Hirudinea |
| —— | Archiannelida |
| —— | Echiuroidea |
| —— | Sipunculoidea |
| —— | Priapuloidea |
| —— | Phoronidea |
| Polyzoa—(few fresh water) | Polyzoa |
| —— | Brachiopoda |
| —— | Chaetognatha |
| Crustacea (fresh water and land) | *Crustacea* (*chiefly marine*) |
| *Insecta* (chiefly land) | Insecta (very rare indeed) |
| Onychophora | —— |
| Myriapoda | —— |
| Arachnida (chiefly land) | Arachnida (very few examples) |
| —— | Tunicata |
| —— | Enteropneusta |
| —— | Cephalochordata |
| Cyclostomata (few fresh water species) | Cyclostomata |
| Teleostomi (fresh water) | Teleostomi |
| Elasmobranchii, rare in fresh water | Elasmobranchii |
| Dipno—(fresh water) | —— |
| Amphibia | —— |
| Reptilia | Reptilia |
| Birds | Birds (at least adapted to life on sea) |
| Mammals | Mammals |

The groups mentioned above are by no means of equal rank, but the table serves to show that representatives of most groups come under the scope of Marine Biology.

So far, however, many may urge that I have not given sufficient reason for the study of Marine Biology; the search for pure knowledge not being deemed sufficient in these busy days! I must plead that I have given above the very best reason. The facts disclosed may not be general or even seem important; they may appear to have no bearing upon human life and economics, but he would be a bold man who would venture to assert that the future would not find use for them. "To be the recipient of the confidences of nature; to realise in all their virgin freshness new facts recognised as positive additions to knowledge, is certainly a great and wonderful privilege, one capable of inspiring enthusiasm as few other things can."

In the last fifty years the discoveries of biology have perhaps affected the human race more than the wonderful attainments in any other branch of learning. There is very much more to think about than the mere classification of animals and plants. The dead bones can live in the hands of those whose observations of the living enable them to interpret the signs of the dead.

But there *is* a second reason for the study of marine biology which may commend itself as the first and more important reason to our commercial spirits. The second reason is bound up with the practical application of the science to Fisheries and other industries.

The British race has to keep up its reputation in the world of science and the fight to-day is by no means easy, nor are the other combatants likely to wait for us. In marine biology England led the world with the famous Challenger Expedition, and the volumes published on the collections made by the famous vessel still remain the foundation of any library of marine biological works. I am afraid, however, in these last few years that the Germans and Americans have taken the lead, and smaller nations like Norway and Denmark have shown that they are not behind us in fishery investigations. A glance at the history of marine biology in the State of Western Australia is somewhat indicative of the same thing. The coast of Western Australia cannot be said to be very well known biologically. In fact, compared with the Mediterranean coast of France and Italy, we might almost say we had a virgin field—at least north of Sharks Bay. Collections were often made in early days by surgeons or amateur naturalists travelling on ships of the early voyagers. Other more general descriptions were given even before this by the leaders of many long-famous expeditions of discovery, as for example, that of Dampier (1652-

1715). Large collections appear to have been made by Péron and le Sueur in 1803, and later still by Quoy and Gaimard. One of our members, Mr. Alexander, is doing excellent work in collecting the information published by many of the old collectors along our shores.

King George Sound, Albany, was quite frequently visited; other collections were made at Sharks Bay. The specimens collected by Quoy and Gaimard were all sent back to the Museum of the Jardin du Roi in Paris, and thus many West Australian marine animals were described for the first time by Lamarck himself. It was Lamarck who suggested in 1790 that the name of the Jardin du Roi should be changed to the more familiar Jardin des Plantes, when during the French revolution, everything suggestive of royalty became obnoxious to the people.

Large numbers of mulluscs, corals, anemones, and ascidia were collected by Quoy and Gaimard.

No doubt numerous odd specimens have been collected and sent from various parts of West Australia to the museums of Europe, and it is becoming increasingly important to trace these, especially such as they have been described and figured as new species.

Unfortunately, many of the early specimens must have been sent with no more information about the locality from which they came than the word *Australia*. The coastline of Australia is, however, not only of considerable length, but is washed by currents of very different origin, and extends across many parallels of latitude and meridians of longitude.

The most detailed investigation of the marine fauna of our coast was undoubtedly that of the Hamburg Expedition of 1905, under the leadership of Michaelsen and Hartmeyer. These two men received every possible help and encouragement—free railway passes, hospitality, and complete remission of duty from their absolute alcohol. They removed from our shores 49 cases of specimens—all of which were carried free to Hamburg by the German Shipping Lines. The history of modern scientific investigation in our colonies very frequently indicates this kind of thing. We have not only refused such help to our own scientific workers, but have deliberately helped a country which is not exactly contented with its present position in the world, to investigate our own grounds.

The Hamburg Expedition only visited the region between Sharks Bay and Albany, yet notwithstanding their 49 cases of specimens, there are probably hundreds of species on the grounds they explored which remain unrecorded. My own few investigations have already given new records for Western Australia, some of which are of very great interest. There is no doubt that workers on the spot can always do more in the way of collecting than those who come from abroad ; provided, of course, that they get the necessary facilities and sympathy. Unfortunately, the material obtained can only be worked up with great difficulty owing to the serious lack of literature in Perth. There is one other difficulty, too, that I must touch on here—a hindrance to the research work of our University professors and lecturers. Probably there are no teachers in the world's universities who are required to put in so much time at actual teaching—"spoon feeding" —as their Australian colleagues. Their value to the State is to a large extent lost.

I do not want it to be imagined that I have attempted above to give any more than an indication of the position of marine biology in our State. Let me now pass to a few more particular points.

## PLANKTON INVESTIGATIONS.

The term "Plankton" was applied in the first case by that veteran physiologist of Kiel, Hensen, to indicate all those organisms floating in the sea which are at the mercy of currents and waves. When we have fully considered the organisms which creep about the sea bottom or are attached to it (the Benthos) ; those which roam at will through the waters as, for example, fishes, marine mammalia, some mollusca and crustacea (the Nekton), we have not exhausted the life of the sea. The voyager sails over a "marine pasture" of microscopic organisms so rich that beneath his vessel is a wealth of life more abundant than perhaps in many a tropical forest. To capture the small organisms of the plankton we need the tow-net of silk, the centrifuge, and the water bottle. Since the development of the Kiel School of Plankton Workers, our knowledge of this branch of marine biology has progressed wonderfully and the mere enumeration of species has given way to a study of seasonal change and the relationship of the plankton to oceanographical conditions. This is bringing us to the study of the ultimate phenomena of life from another point of view altogether. The study of the plankton off the West Australian coasts will be of importance in connection with our Fisheries (many fish eggs are pelagic), and also in another commercial undertaking of great value, the cultivation of the Pearl Oyster.

Up to the present time we have no knowledge of the seasonal changes in the plankton at any place South of the Equator. This is a subject we hope to take up at the University—as soon as we can find the necessary time. The few investigations already made have shown that every year about June there is a regular appearance of the Ephyrae of Aurelia in large numbers in the Swan River. Before this month (but variations have taken place probably owing to early or late rains and the consequent rush of fresh water into the estuary), the tow-net reveals the presence of the larvae of our common prawns belonging to the genus Penaeus or Metapenaeus. These larvae are particularly interesting, for it is extremely rare for the Decapod crustacea to be hatched from the eggs as Nauplii. It is known in several cases in the group Penaeidae. We have obtained the nauplius larvae of the Swan River species, and it would appear as if the complete development could be worked out quite easily from a complete series of plankton catches.

Our Swan River and Fremantle Harbour catches have also indicated the presence of Phoronis in our waters. The adults have never yet been recorded, but must occur, for we have captured Actinotrocha larvae in the plankton. Our Swan River estuary plankton and also that collected between Garden Island and Fremantle seems at times to be particularly rich in Tintinnidae. Great swarms occur, and on one occasion the presence of these organisms was found to be associated with a fine display of so-called phosphorescence. Amongst the phytoplanktonic forms the well known genera Chaetoceros, Rhizosolenia, Ceratium and Peridinium abound, but it is impossible to work out the species with the literature at our disposal.

The plankton work remains in fact untouched. The Hamburg Expedition must have made very extensive collections, but up to date nothing has been published except a small paper by Lohmann on pelagic Tunicata.

Amongst larger planktonic organisms we can record Porpita, Physalia, and Beroe. The latter genus occurred in myriads in Bunbury Harbour in May, 1913.

### MOLLUSCA.

The Mollusca are probably as well known as any marine group from the Western Coast of Australia. I should like to add a few words upon this group, which perhaps has received more of my notice in the past than any other Phylum. Two groups of molluscs are of outstanding importance, economically, on our coasts, and in very different ways. One group, that of the shipworms belonging to the genus Nausithoria, is a pest, causing the destruction of wooden piles at Bunbury, Fremantle, and other ports to the extent of thousands of pounds sterling. The other group is of value, and includes the species eagerly sought after for pearls and pearl shell.

The common species of "shipworms" (the best known genus is Teredo), found at Fremantle are *Nausithoria saulii* and *Nausithoria thoracites*, the first-named being recorded here for the first time from West Australia. Both species attack the jarrah piles. The life history and anatomy are fairly well known, and the Biology Department of the University has made some investigations into the matter at Fremantle. This is an excellent example of the most unexpected kind of connection between two subjects very rarely associated with each other—marine biology and engineering. The larvae of Nausithoria occur in the plankton. They die if they do not come up against a suitable material for attachment and boring. It does not take long for penetration of timber, and three months after immersion specimens have been found some little distance in the wooden jetty piles.

Let us now look at the other important lamellibranch on our coasts. The pearl oyster fisheries of Australia are probably the largest and best equipped at the present time in the world. The value of pearls and pearl shell is by no means inconsiderable, and the industry is without doubt a great asset to Australia. Now there is a great danger that fishing will be conducted without any scientific supervision until perhaps some serious trouble arises, such as, for example, has arisen in Ceylon. Then, of course, a scientific investigator will be called in. This, however, is more than shutting the stable door after the horse has gone ! The first thing that a marine biologist would have to do if called in, would be to make a study of the conditions under which pearl oysters had developed; you cannot call upon a biologist as you can upon a chemist or engineer, for problems in natural history are often peculiarly local. Besides there are very few marine biologists with any real knowledge of pearl oyster beds. Would it not be well worth the expenditure, therefore, as a kind of insurance, to have our pearl oyster banks studied in detail by scientists in conjunction with pearl fishers *before* there is any restriction in the supply?

We want to know something about the enemies of the oysters on the North-West Coast, the breeding season, the deposition of spat, the cause of pearl formation, and the extent to which fishing is carried out.

## Hydrographical Conditions and the Marine Fauna.

As more and more extensive collections of our marine animals are made and a greater knowledge of their distribution is obtained, we find that certain species occur only in the North, others are characteristically Southern, and others again may be very local and only found on certain types of sea bottom. We have a considerable stretch of coast line which runs roughly North and South—consequently extending through many degrees of latitude. This makes the study of geographical distribution very interesting, and it is still more so because the North-West Coast fauna is probably in many ways a connecting link between the Indian and Pacific faunas.

Our large pearl oyster, *Margaritifera maxima*, does not extend down into Sharks Bay. Its place is taken there by a smaller species, more valuable for its pearls than for its shell. True coral reefs are not found South of Sharks Bay with one peculiar exception—the Houtman's Abrolhos—islands situated about 30-50 miles off the Australian coast in Latitude 28° 30′ S. The fauna of Sharks Bay is, in fact, almost tropical, but a rapid diminution in the number of these tropical species occurs as one follows the coast southward, until at Albany one meets with some typical Antarctic elements. The Abrolhos Islands occupy a rather interesting position, and Saville Kent, after a visit, stated that the marine fauna was not only a blend of tropical and temperate species, but that the tropical species were not found on the adjacent coast. The Hamburg Expedition did not visit these islands, but the members apparently agreed with the views expressed by Kent after an examination of certain collections in the West Australian Museum. With these statements in mind, and the fact that the Islands were good collecting grounds for the marine biologist, Mr. W. B. Alexander, of the West Australian Museum, and I visited the Abrolhos last November. Extensive collections were made and these will be worked up in due course by specialists on the various groups. One of the questions which calls for investigation is the problem of the Hydrographical Conditions. If an examination of the fauna of the Abrolhos supports the views of Saville Kent, then what is it that determines the Southern extension of tropical organisms at this place? The study of the hydrography of this region is but a small section of an investigation which is called for along the entire coast.

The islands are, so far as we could see, entirely composed of up-lifted and wave-heaped coral. There is no evidence whatever for the statement of Saville Kent that plutonic rocks corresponding to those of the mainland occur in the Wallaby Group. The Wallaby Islands, like the others of the Abrolhos Group, are coral formations. The rich growths of coral would certainly encourage us to look for some influential hydrographical conditions. Let me discuss some of the information that we now possess and some of the theories put forward.

Saville Kent stated that he found the sea temperature was 14°F. higher at the Abrolhos than at Geraldton on the coast at the same time, and during the month of July, 1894. He suggested that a warm current of water came down from the Tropics—a Southerly intrusion of an equatorial current perhaps not exactly reaching the islands, but approaching them. Kent did not give sufficient details of any temperature observations made by him. Michaelsen, who has stated that one must travel about 6° latitude North of Sharks Bay in order to meet a coastal fauna similar to that of the Abrolhos, believes that if a warm current *does* exist it is not the only factor. His suggestion is that an upwelling of cold water takes place along the coast which is driven outwards along the surface. Quite apart from our studies, it is important from the point of view of fishery investigation that we should know something of the movements of the water along our coasts. Now, in order to obtain a clue to these, one looks quite naturally for temperature observations. We look in vain, however, for any organised coastal records. It is rather strange that the Meteorological Department has not arranged long ago for sea temperatures at its coastal stations. We have fortunately some data collected by Mr. J. J. East, of Perth. This gentleman has worked out carefully the sea temperatures taken by the engine-room staffs on various steamers—mail and coastal—in Australian waters. The temperatures apply to the sea water as pumped into the condensers, and of course cannot be relied upon as quite as accurate as readings made with certificated thermometers and the usual oceanographical apparatus. The results, however, go some way to fill up a big gap and they are quite interesting. The coast of West Australia appears to be washed by water the temperature of which ranges from about 60°-67°F. on the South to 74°-87°F. on the North-West coast. The seasonal change is thus not very great. The highest seasonal temperatures recorded in the short period of observation occurred in February and March; the lowest in August and September.

At Geraldton, the nearest port to the Abrolhos, the sea temperatures vary from about 62°F. in winter to 74°F. in summer.

Now the temperatures taken as one leaves the coast between Geraldton and Sharks Bay indicate that the inshore waters are colder than those some little distance out, and a map showing the isotherms plotted from engine-room temperatures (June, 1911) shows a very distinct tongue of warm water passing down the coast, the tip reaching down to about the Abrolhos. A very distinct zone of cold water appears at times lying close to the coast and extending from the Leeuwin northwards, even north of Sharks Bay.

Temperatures taken by me at the Abrolhos also indicate the presence of warmer water there than was found in the harbour of Geraldton at the same time, although the difference was not half that which Saville Kent recorded in 1894. There is, therefore, a considerable mass of evidence in favour of a tropical current passing southward some distance out from the coast and gradually disappearing as the Abrolhos are approached. This would lead one to expect a curious distribution of marine organisms in that area of the Indian Ocean, including the Abrolhos Islands, and washing the mainland near Geraldton. We hope to be able to map out in some detail this distribution.

Up to date I have little, if any, evidence supporting the German contention that the upwelling of colder water along the coast might account largely for the marine fauna of the Abrolhos Islands. If such a thing took place, caused by the factors suggested by Michaelsen, it would in my opinion occur at the Abrolhos Islands themselves, for they are situated right on the edge of the continental shelf. A correct series of surface to bottom temperatures, taken as one passes out from the coast until deep water (over 200 fathoms) is reached, would doubtless settle this case. We have the apparatus and it is merely the question of obtaining the loan of a suitable steamer for a day or so, perhaps four times a year, which prevents us from obtaining the figures.

## OUR NEAREST CORAL ISLANDS—THE ABROLHOS.

The Abrolhos Islands have already been mentioned several times in this address. As a matter of fact it is very probable that these islands will be one of our most conveniently situated and richest collecting grounds for some time to come. They are probably the most southerly coral islets in the world, and, since the question of coral reef formation is still a much discussed problem, their close vicinity to Perth should enable us to collect some important information. I am afraid that their distance from Perth is not expressed correctly by merely referring to it in miles. It should be expressed in time, or in money, for it is not so easy to reach the Abrolhos as a resident in another land might imagine after using his atlas.

There are several groups of islets making up the Abrolhos which are separated by channels. From North to South they are as follows:—The Wallaby Islands with North Island—the Easter Island Group—The Pelsart Group. The northerly islands attain the greatest heights above sea level (maximum between 40 and 50 feet only) and appear to have been subjected to the greatest alteration by uplift and denudation. The Pelsart Group is quite atoll-like in character, and the individual islets are only a few feet above the sea level. The Wallaby Islands at least have been connected with the mainland in comparatively recent times (geologically speaking), and the land fauna is consequently rather curious now by reason of the wallabies, reptiles, and amphibia which abound on these small coral islets 50 miles away from the coast.

It is difficult to speak with any certainty about the early formation of the Abrolhos Islands, especially since theories of the formation of coral islets, where the sequence of events has not been complicated by elevation and subaerial denudation, have so far not been exactly successful.

It does not seem probable, however, that the atoll-like Pelsart Group has developed in the way suggested by Darwin. There is evidence everywhere of the action of the sea.

The two Wallaby Islands have been separated by erosion and solution, and very many of the islands are now being cut away to the mean sea level by the action of the waves and currents. Most of the cliffs overhang, and this undercutting continues until huge blocks break away.

It would appear that the islands now forming the Wallaby Group were once joined up and the coral mass was much more extensive than at present. The present condition is the result of subsidence and erosion followed by a more recent small uplift and then further erosion. There is considerable evidence for this small recent uplift, the extent of which is about eight feet. In fact, many of the small islands are probably only islands at present owing to this elevation. They had previously been cut down to sea level. One is tempted at first to assume that the Abrolhos are coral islets of past times and that the conditions which brought them into being are nonexistent now at this place. I think, however, that on second thought this view will be dismissed. The Pelsart Group would hardly have retained its atoll-like structure unless the conditions favouring the growth of reef-building corals were very recently prevailing. Moreover, in suitable places in the lagoons one finds great masses of living corals, two species of Madrepora with very different growth habits being most abundant. No single theory of coral island formation is going to expain the various coral formations of our tropical seas. Every coral island or group of islets needs separate examination before its mode of origin can be explained, and the Abrolhos Islands offer problems for almost every branch of oceanographic research.

### NOTES ON SOME ANIMAL GROUPS, CHIEFLY MARINE.

The following brief notes contain several new records made during the past fourteen months. In many cases it is impossible for us to determine species owing to the absence of literature. It may be of some little value to refer to the genera, especially as they are in certain cases first records of their Phyla or Sub-Phyla from the West Australian Coast.

**Sponges.**—Very little systematic work has been carried out on our sponge fauna up to date. The coast appears, however, to be particularly rich in sponge species. Two reports of the Hamburg Expedition collections refer only to the Tetraxonida of the South-West. At the present time Professor Dendy has our collection from the Abrolhos for the purpose of investigation. Most of the specimens of the Tetraxonida collected by Michaelsen and Hartmeyer were quite new to science.

**Coelenterata.**—We possess very little knowledge of the Coelenterata of Western Australia. Two papers have so far appeared on the specimens collected by the German expedition—one on the Actiniaria and another on certain Alcyonaria. Many of our corals have been named, but a revision of this work is badly needed. Although reef-building corals are stated not to occur south of Sharks Bay, except at the Abrolhos, *some* species of corals may be obtained considerably further south. Thus, Pocillopora in the living condition has been dredged up at Garden Island on one or two of our expeditions, and Turbinaria also occurs, and extends as far south as Bunbury. Almost all the Alcyonaria so far recorded came from Sharks Bay—the family Nephthyidae being well represented with species peculiar to our coast. Two Pennatulids only have been named. There are practically no records of hydroids, but a species of Sertularia occurs and is very common along the coast on the Zostera. On one of our dredging expeditions we discovered large quantities of *Tubularia sp.* on the piles of the Fremantle Jetty. This is, so far as I am aware, the first record of this Gymnoblast on our coast. I have referred elsewhere to the occurrence of Porpita and Physalia. These oceanic pelagic coelenterates were captured at the Abrolhos Islands.

**Nemertinea.**—Several beautiful specimens of the Heteronemertean *Cerebratulus sp.* have been dredged off Garden Island. They were, when extended, about six to eight inches long. Only one other nemertean has been obtained so far, and that has not yet been examined.

**Chaetognatha.**—Few chaetognaths, and those but of small size, have occurred in the plankton catches made so far. We have not made many, however, and so this may not indicate much. The genus represented seems more usually to be *Spadella sp.*

**Polychaeta.**—The Polychaetes are practically unrecorded from the coast of Western Australia, but fine examples occur, and a number of different species have been collected and await examination.

**Echiuroidea.**—In the course of our collecting at the Abrolhos Islands, two specimens of *Bonellia sp.* were obtained. Since then several specimens have been found by dredging in Freshwater Bay (Swan River Estuary) and off Garden Island. The species is moderately large but until the whole group of the Bonellida is revised it is difficult to determine the species with any certainty. The colour is the typical green. This is the first record, so far as I am aware, of this Group on our coast.

**Polyzoa.**—Polyzoa appear more common than Hydroids in the Fremantle district and *Retepora sp.* and a species of Bugula are fairly common as well as some encrusting forms not yet investigated. Perhaps the most striking species is *Amathia spiralis* which occurs in great masses off Garden Island and has been dredged there on almost every occasion on which I have visited the grounds.

**Mollusca.**—The Mollusca are on the whole better known systematically than any other marine group on our coast, and a large report has just been completed by Hedley, of the Australian Museum, Sydney. Very many of the familiar genera of the European coast are represented but by different species. About 100 species of lamellibranches at least have been recorded from the South-West alone. Probably our most important bivalve is the large pearl oyster *Margaritifera maxima,* but this is confined to the North-West. The "shipworms" (*Nausithoria sp.*) have already been alluded to.

A very large number of Gastropoda have been recorded and some are extremely common. Vermetus is responsible for great shelly tracts at Geraldton and the Abrolhos, but also occurs further south, and can be seen on the beach near Fremantle.

The Nudibranchiata appear to be well represented on our shores, and many of the species are new. Several specimens of the beautiful *Hexabranchus imperialis* have been captured at the Abrolhos, the locality where it was first discovered by Kent in 1897. Another interesting form is a species of Notodoris, recorded now for the first time from the Australian coast. The genus was instituted by Bergh for a single specimen, *N. citrina* from Rarotonga. Two other species have since then been made by Eliot for specimens from Zanzibar and the Maldive Islands. All the species are yellow in colour. It is stated in Eliot's report that nothing is known of the habits of these animals. Several specimens of Notodoris were obtained at the Abrolhos, and they may also belong to a new species. The animals were bright lemon yellow in colour, and no colouration could have been more conspicuous. Yet in all probability we missed many specimens, for they were living on a sponge of exactly the same colour as themselves, which formed encrustations on the under surface of great blocks of dead coral. The first specimen captured gave itself away by falling off a stone as it was being turned over.

About 45 species of Polyplacophora are recorded up to date from the West Australian coast.

**Crustacea.**—Very much work requires to be done in collecting and working out the Crustacea of Western Australia. Only about 15 species of the Decapoda are recorded for W.A. in Haswell's Catalogue of the Australian Malacostraca in 1882. Very many examples, however, must have been collected from time to time, and these have been named at various institutions, but unfortunately no list of these records is available. Our Abrolhos collections await investigation, and nothing has yet been published by the Hamburg Expedition. The only group that we can investigate with the literature at our disposal is the group Stomatopoda, thanks to the Monograph published by the Indian Museum, Calcutta. Upwards of seven species of this group have been recorded, and six of them are Indo-Pacific forms.

Specimens of *Nebalia sp.* representing the group Leptostraca occur off Fremantle. What a remarkably wide distribution this genus has! It was first found at Greenland, and it ranges from there to Chile and Japan.

The Mysidacea are but little known from our waters, and much very important work requires to be done in collecting these crustacea which have probably evaded the more general collecting apparatus used along this coast. Probably a light net—something between a dredge and a tow-net—used over the Zostera beds would result in their capture.

Numbers of Anomura have been captured, and three of the four tribes making up this section are known to occur—The Galatheidea, Thalassinidea and Paguridea. What is probably the first record of the Thalassinidea is a fine specimen of Thalassina itself, dredged in the mud of the Swan River right opposite Perth.

Alpheids appear to be abundant down the coast, and the same may be said of the Sphaeromidae, a family of Isopods. A very near relative of the family, *Limnoria sp.*, occurs in thousands in Fremantle Harbour, boring into the piles and preparing the surface for the attacks of the "shipworms." It is a species of Limnoria which works similar havoc in many parts of the world far removed from Australia, is known popularly as the Gribble, and was first discovered as a British species by Robert Stevenson, the lighthouse engineer, who found it destroying the timber used in the erection of the Bell Rock Lighthouse.

**Echinodermata.**—The Crinoids, Ophiuroids, Asteroidea and Echinoidea are tolerably well known from the region south of Sharks Bay, but a gap remains in our knowledge of the phylum, even in this region, owing to the absence of information on the Holothurians.

Holothurians are quite common and several genera have been collected; in some places the sea bottom is particularly rich in these echinoderms. A collection will be sent away in due course for examination by Dr. Pearson, of the Colombo Museum, Ceylon.

The other groups are better known, owing to the work of the West Australian Museum and that of the Hamburg Expedition in collecting these forms. Thirty-one crinoids have been recorded from the West coast of Australia. Thirty-two Ophiuroids are known from the South-West region of our coast, and about eighteen species of Asteroidea. This latter number certainly does not represent all the species so far collected. Some large specimens of a species of Luidia more than a foot across have been dredged near Garden Island. It is very difficult to preserve them without breakage of the arms taking place.*

**Tunicata.**—The phylum Tunicata is one of the dominant groups of marine animals on our coast, and the jetty piles at all the seaports are covered with these organisms.

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*Since reading this address, the West Australian Museum have published a list of the Echinoderms in their collection. It is probable that the species recorded as *Lindia maculata* M. & I., is *Luidia maculata*. It is very probable that our large specimens belong to this species, which occurs at Ceylon, No reports, however, on West Australian species are yet to hand. Out of 183 species given by Herdman as occurring on the coast of Australia, only six are definitely recorded for the West although, of course, very many more must be common to both East and West coasts. The Hamburg Expedition has, so far, only published records on the few pelagic forms captured—the genera Doliolum, Oikopleura and Fritillaria being all that were thus represented in their catches. Simple and compound forms abound everywhere and immense quantities of a *Ciona sp.* may be dredged at times in the Swan River estuary (Freshwater Bay). Our Abrolhos collections are now in the hands of Professor Herdman for examination.

**Enteropneusta.**—Perhaps the most interesting animal collected from the Abrolhos Islands is a new enteropneust which I have named *Ptychodera pelsarti,* after Pelsart, whose ship, the "Batavia," was wrecked on one of the islets in 1629. This is the first enteropneust to be recorded from the West coast of Australia. None have been recorded from the Southern coast, but two species are known from the East. They belong, however, to different genera, so that this is the first record of the genus Ptychodera from Australian waters.

The species resembles most closely the type generally regarded as *Ptychodera flava,* "varieties" of which are known from the Laccadive and Maldive Islands in the Indian Ocean, and from certain islands in the Southern Pacific.

The animals occur in the shelly ground in rockpools along the extreme southern part of the Pelsart Island reef, quite close to the southern extremity of Pelsart Island itself. They possess the characteristic features of the group now restricted as the Ptychoderidae (Spengel). The species differs from previously known forms in respect chiefly to the Nuchal Skeleton and other anatomical features. A paper describing the species in detail is now in the Press, and should be published shortly in the Trans. Linn. Soc., London.

I am afraid that my Anniversary address has been something of the nature of a "patchwork quilt"! I can only say, by way of excuse, that our knowledge of the marine fauna of West Australia *is* very patchy. Members of the Royal Society can do a great deal to remedy this state of affairs, for there are many people in the State who are resident on the shores of the Indian Ocean, and interesting objects are frequently washed up in the living condition after storms. Residents in the North-West might obtain many valuable specimens from the pearl fishers—valuable to the scientist, and of no possible use to the fishermen. These specimens should be preserved in spirits or formalin and forwarded to the University. We intend, of course, to build up gradually a small teaching collection, but specimens (and these will probably be the more numerous) which do not exactly come under the category of a University teaching collection will find a resting place in the West Australian Museum. This institution should house, if possible, a specimen of every species found upon our coasts. It will then be fulfilling what is to my mind its most important function, and its collection will be of value both to the scientist and the layman: to the seeker after real information, as well as to the mere curiosity-monger.